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(54) Title of the invention: SEMICONDUCTOR WAFER PROCESSING METHOD

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(72) Inventor: Tsuneo HAMAGUCHI
c/o NEC Co., Ltd. 33-1, 5-Chome Shiba, Minato-ku, Tokyo

(71) Applicant: NEC Co., Ltd. 33-1, 5-Chome Shiba, Minato-ku, Tokyo

(74) Representative: Susumu UCHIHARA, Patent Attorney

SPECIFICATION

TITLE OF THE INVENTION

Semiconductor Wafer Processing Method

SCOPE OF PATENT CLAIMS

A semiconductor wafer processing method wherein a rotating semiconductor wafer is moved relative to a translucent polishing plate while maintaining a specific gap, the surface of the semiconductor wafer to be polished and the polishing plate described above are immersed in a polishing solution made up of a chemical solution containing a mix of polishing granules, and light is projected from the side opposite the polishing plate described above onto the aforementioned surface to be polished.

DETAILED DESCRIPTION OF THE INVENTION

Industrial Field of Application

The present invention relates to a method for processing semiconductor wafers, and in particular, relates to a method for processing semiconductor wafers in which the semiconductor wafer surface is polished to a distortion-free, mirror surface.

Prior Art

Conventional semiconductor wafer processing methods include the removal of minute amounts of the wafer surface by rolling or sliding polishing granules over the semiconductor wafer surface, or a chemical polishing in which etching is used. However, these methods were not always satisfactory with respect to the processing efficiency or the surface smoothness.

The processing method for which the inventors of the present invention submitted the application JSP S60-112275, is a semiconductor wafer processing method that improves the above methods. In that processing method, a polishing pad, in which a window is made that allows light to pass through, and a semiconductor wafer are positioned so that they are opposed to each other with a chemical solution in between. Light is projected through the window onto the surface of the chemical solution and the semiconductor wafer while the semiconductor wafer and the polishing plate are moved relative to each other, polishing the semiconductor wafer surface to a mirror finish.

Problems the Invention is to Solve

The conventional semiconductor wafer processing methods described above use a polishing plate that has a window, and this creates an area on the semiconductor wafer surface that the projected light cannot reach. In the area where the light

is projected, the semiconductor wafer and the chemical solution enter into a state of excitation and the processing speed is faster than in the areas where the light is not projected. This leads to the problem of the generation of irregularities in the semiconductor wafer surface that correspond to the size of the window in the polishing plate.

Furthermore, when attempting to flatten the surface of a semiconductor wafer that has been formed using two different types of materials, the problem is that the etching effect of the chemical solution on the materials is different, which makes it impossible to make the semiconductor wafer surface flat.

The object of the present invention is to provide a semiconductor wafer processing method that produces semiconductor wafers with superior flatness and that does so efficiently.

Means for Solving the Problems

The configuration of the present invention's method for processing semiconductor wafers is equipped with a rotating semiconductor wafer that is moved at a specific gap relative to a translucent polishing plate. The surface of the aforementioned semiconductor wafer that is to be polished and the polishing plate described above are immersed in a polishing solution that contains a mixture of polishing granules. Light is projected onto the above-described surface to be polished from the opposite side of the polishing plate described above.

Effect

The present invention makes it possible to efficiently impart a flat surface to a semiconductor wafer. A uniform light is projected during the entire processing period onto the semiconductor wafer surface and the polishing solution that is made up of a chemical solution containing polishing granules. This causes the surface of the semiconductor wafer and the polishing solution to become uniformly, thermally, or optically excited, promoting the reaction between the semiconductor wafer and the polishing solution. Moreover, by moving the polishing plate and the semiconductor wafer relative to each other with a polishing solution containing polishing granules in between, the rotation and sliding of the polishing granules at the semiconductor wafer surface becomes more active, improving the process and allowing a flat surface to be produced.

Embodiments

We will explain below the embodiments of the present invention with reference to the drawings.

Figure 1 is a side view of the semiconductor wafer polishing device, using an embodiment of the present invention.

In Figure 1, the semiconductor wafer 2 is a semiconductor wafer substrate that is made up of silicon oxide and silicon and has surface irregularities of 200 nm.

The semiconductor wafer 2 is affixed to the support substrate 1, which can rotate. Polishing plate 4 is placed between the wafer and a mercury lamp or similar light source 3. Polishing plate 4 is made of quartz glass, which can admit the light from light source 3. Inside tank 5, which is made of the same material as polishing plate 4, polishing plate 4 is supported by support 6, which can rotate.

Polishing solution 7, which consists of a mixture of polishing granules made from silicon dioxide in a chemical solution of sodium fluoride, is poured into tank 5. The surface of semiconductor wafer 2 that is to be polished is immersed along with polishing plate 4 into polishing solution 7.

The gap between semiconductor wafer 2 and polishing plate 4 is set to 10 μm. While projecting ultraviolet light 8 from light source 3 onto the surface of semiconductor wafer 2 that is to be polished, semiconductor wafer 2 and polishing plate 4 are rotated in the directions indicated by the arrows in Figure 1, with polishing solution 7, which is held in tank 5, in between. This rotation moves the semiconductor wafer and polishing plate 4 relative to each other and polishes the surface of semiconductor wafer 2 to be polished.

By projecting ultraviolet light 8, semiconductor wafer 2 and the optical solution made up of polishing solution 7 go into a state of excited activity, and semiconductor wafer 2 and the optical solution react more easily. Thus, the processing speed of semiconductor wafer 2 rises. Moreover, the polishing granules mixed into polishing solution 7 pass through the gap between polishing plate 4 and semiconductor wafer 2, flattening and smoothing the surface of semiconductor wafer 2. As a result, we were able to produce a semiconductor wafer with surface irregularities of 20 nm.

Note that we used silicon for the semiconductor wafers in this embodiment, but the processing method of the present invention could be applied to other monocrystalline semiconductor substrates as well, such as GaAs and InP. In that case, it goes without saying that the type of light source and materials in the polishing plate could also be selected.

Effect of the Invention

As explained above, the semiconductor wafer processing method of the present invention makes uniform use of light energy on a semiconductor wafer surface and polishing solution. The lubricating effect of the polishing granule fluid mixed with the polishing fluid has the effect of making it possible to efficiently produce semiconductor wafers with superior flatness.

Brief Description of the Drawings

Figure 1 is a side view of the semiconductor wafer polishing device using an embodiment of the present invention.

1: Support substrate; 2: Semiconductor wafer; 3: Light source; 4: Polishing plate; 5: Tank; 6: Support rod; 7: Polishing solution; 8: Ultraviolet light.

Representative: Susumu UCHIHARA, Patent Attorney [seal]

<table>
<tr><td></td><td>7. Polishing solution</td><td></td><td colspan="2">1. Support Substrate</td></tr>
<tr><td colspan="4">[See original for diagram.]</td><td>2. Semiconductor Wafer</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5. Tank</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>4. Polishing plate</td><td>6. Support rod</td><td>3. Light source</td><td>8. UV light</td></tr>
<tr><td></td><td colspan="3">Figure 1
[see source for diagram]</td><td></td></tr>
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METHOD OF WORKING SEMICONDUCTOR WAFER

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Applicant:	NEC CORP
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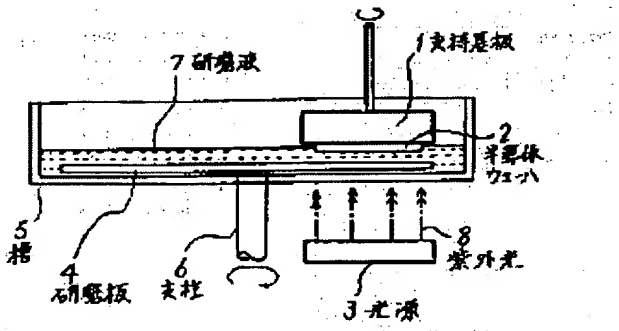
Abstract of **JP62211927**

PURPOSE:To efficiently work a semiconductor wafer so as to provide it with superior flatness, by arranging the semiconductor wafer so as to face a polishing plate, dipping the surface of the wafer and the polishing plate in polishing liquid, and applying light to the surface to be polished while moving the wafer relatively with respect to the polishing plate.

CONSTITUTION:Polishing liquid 7 is injected into a tank 5 and the surface of a semiconductor wafer 2 to be polished and a polishing plate 4 are dipped in the polishing liquid 7. Ultraviolet rays 8 from a light source 3 are applied to the surface of the wafer 2 to be polished, while the wafer 2 and the polishing plate 3 are rotated with the polishing liquid disposed therebetween. Thereby, the surface of the wafer 2 and the polishing liquid 7 are optically or thermally excited uniformly and the reaction between the wafer 2 and the polishing liquid 7 are promoted. In this manner, the wafer 2 can be worked efficiently so as to have superior flatness.



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⑭発明の名称　半導体ウエーハの加工方法

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⑫発明者　濱口　恒夫　東京都港区芝5丁目33番1号　日本電気株式会社内
⑪出願人　日本電気株式会社　東京都港区芝5丁目33番1号
⑭代理人　弁理士　内原　晋

明　細　書

発明の名称

半導体ウェーハの加工方法

特許請求の範囲

回転する半導体ウェーハを所定間隙をもって透光性を有する研磨板に対向して相対的に移動し、前記半導体ウェーハの研磨面と前記研磨板とを砥粒を混合した化学液から成る研磨液に浸し、前記研磨面に前記研磨板の反対側から光を照射することを特徴とする半導体ウェーハの加工方法。

発明の詳細な説明

〔産業上の利用分野〕

本発明は半導体ウェーハの加工方法に関し、特に半導体ウェーハの表面を無歪鏡面に研磨する半導体ウェーハの加工方法に関する。

〔従来の技術〕

従来の半導体ウェーハの加工方法は、砥粒が半導体ウェーハ面上を転動又は滑動することにより、ウェーハ表面を極微少量ずつ除去する方法あるいはエッチングによる化学研磨の方法がある。しかしながら、これらの方法は、加工能率や表面平滑性の点で必ずしも満足できるものでなかった。

本願発明者が先に出願した特願昭60－112275号による加工方法は、上記の方法を改良した半導体ウェーハの加工方法である。その加工方法は、光を通す窓を設けた研磨板と半導体ウェーハとを化学液を介して対向するように配置し、窓を通して、化学液及び半導体ウェーハの表面に光を照射しながら、半導体ウェーハと研磨板とを相対運動させることにより、半導体ウェーハ表面を鏡面研磨している。

〔発明が解決しようとする問題点〕

上述した従来の半導体ウェーハの加工方法は、窓を設けた研磨板を用いるため、半導体ウェーハの表面上で光が照射される部分とされない部分が生じ、光が照射される部分では、半導体ウェーハ

及び化学液が励起状態となり、光が照射されない部分に比べ加工速度が速くなり、半導体ウェーハ面上に研磨板の窓の大きさに対応した凹凸が生じるという問題点がある。

更に、表面が異種材料で形成された半導体ウェーハの表面平坦化を行う場合には、化学液の材料へのエッチング作用が異なるため半導体ウェーハ表面を平坦にすることができないという問題点がある。

本発明の目的は、平面度の優れた半導体ウェーハを能率良く加工できる半導体ウェーハの加工方法を提供することにある。

〔問題点を解決するための手段〕

本発明の半導体ウェーハの加工方法は、回転する半導体ウェーハを所定間隙をもって透光性を有する研磨板に対向して相対的に移動し、前記半導体ウェーハの研磨面と前記研磨板とを砥粒を混合した化学液から成る研磨液に浸し、前記研磨面に前記研磨板の反対側から光を照射するように構成される。

〔作　用〕

本発明によれば、半導体ウェーハ表面及び砥粒を混合した化学液から成る研磨液に加工期間中を通じて一様に光を照射することで半導体ウェーハ表面及び研磨液が光学的又は熱的に一様に励起されて半導体ウェーハと研磨液との反応を促進し、更に、砥粒を含む研磨液を介して研磨板と半導体ウェーハとを相対運動させることで半導体ウェーハ表面での砥粒の転動及び滑動を活発化し、加工性を向上し能率よく平滑な表面加工を行うことができる。

〔実施例〕

次に、本発明の実施例について図面を参照して説明する。

第１図は本発明の一実施例を用いた半導体ウェーハ研磨装置の側面図である。

第１図において、半導体ウェーハ２は表面が二酸化シリコンとシリコンとから形成され、表面の凹凸が２００ｎｍである半導体ウェーハ基板である。

回転可能な支持基板１に接着された半導体ウェーハ２と、水銀ランプ等の光源３との間に研磨板４が配置される。研磨板４は光源３の光を通すことができる石英ガラス製であり、研磨板４と同一の材料で作られた槽５の中に回転可能な支柱６に支持されている。

槽５の中にはフッ化ナトリウムの化学液に二酸化シリコンから成る砥粒を混合した研磨液７が注入され半導体ウェーハ２の研磨面と研磨板４とは研磨液７に浸されている。

半導体ウェーハ２と研磨板４の間隙を数１０μｍとし、半導体ウェーハ２の研磨面に光源３から紫外光８を照射しながら槽５に保持された研磨液７を介して、半導体ウェーハ２と研磨板４とを第１図に矢印で示す方向にそれぞれ回転させる。この回転によって、半導体ウェーハ２と研磨板４とは相対運動を行い、半導体ウェーハ２表面の研磨面が研磨される。

紫外光８を照射することにより、半導体ウェーハ２及び研磨液７を構成する光学液は励起活性状態になり、半導体ウェーハ２と光学液が反応し易くなる。従って、半導体ウェーハ２の加工速度が上昇し、更に、研磨板４と半導体ウェーハ２との間隙を研磨液７に混合された砥粒が通過して、半導体ウェーハ２の表面を平滑化する。この結果、表面の凹凸が約２０ｎｍの半導体ウェーハが得られた。

なお、本実施例では半導体ウェーハはシリコンを用いたが、他の半導体単結晶基板、例えば、ＧａＡｓ，ＩｎＰについても本発明の加工方法を適用できる。その場合、光源の種類・研磨板の材料を選択できることは言うまでもない。

〔発明の効果〕

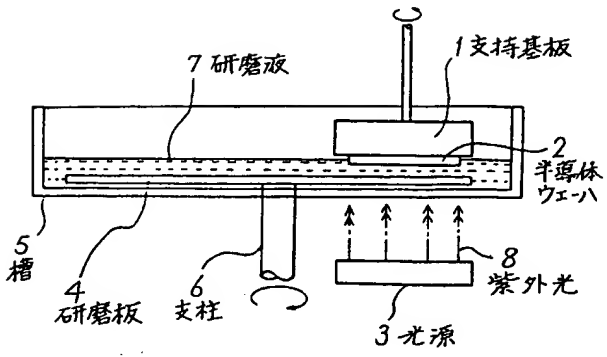
以上説明したように本発明の半導体ウェーハの加工方法は、加工の全期間にわたり光エネルギを半導体ウェーハ表面及び研磨液に一様に作用させると共に、研磨液に混合した砥粒の流体潤滑作用を併用することにより、平面度に優れた半導体ウェーハを能率良く加工できるという効果がある。

図面の簡単な説明

第１図は本発明の一実施例を用いた半導体ウェーハ研磨装置の側面図である。

１…支持基板、２…半導体ウェーハ、３…光源、４…研磨板、５…槽、６…支柱、７…研磨液、８…紫外光。

代理人　弁理士　内　原



第１図